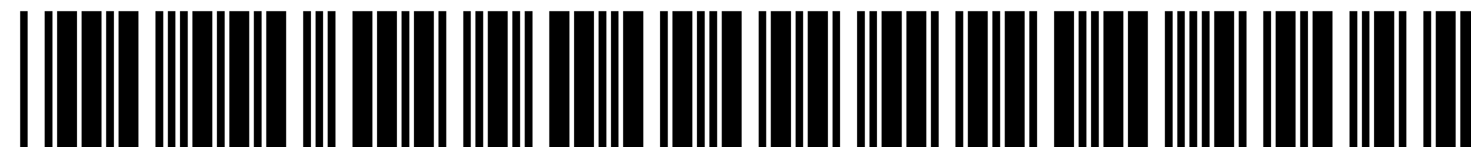

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Walter et al.

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(45) **Date of Patent: Apr. 27, 2021**

(54) **CARRIER FOR AN OPTOELECTRONIC COMPONENT, METHOD OF PRODUCING A CARRIER FOR AN OPTOELECTRONIC COMPONENT, WAFER AND SOLDERING METHOD**

(71) Applicant: **OSRAM Opto Semiconductors GmbH**, Regensburg (DE)

(72) Inventors: **Christoph Walter**, Regensburg (DE); **Roland Enzmann**, Regensburg (DE); **Markus Horn**, Straubing (DE); **Jan Seidenfaden**, Neumarkt i.d. Oberpfalz (DE)

(73) Assignee: **OSRAM OLED GmbH**, Regensburg (DE)

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H01L 23/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H01L 33/44*** (2013.01); ***H01L 24/00*** (2013.01); ***H01L 33/62*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H01L 33/62
See application file for complete search history.

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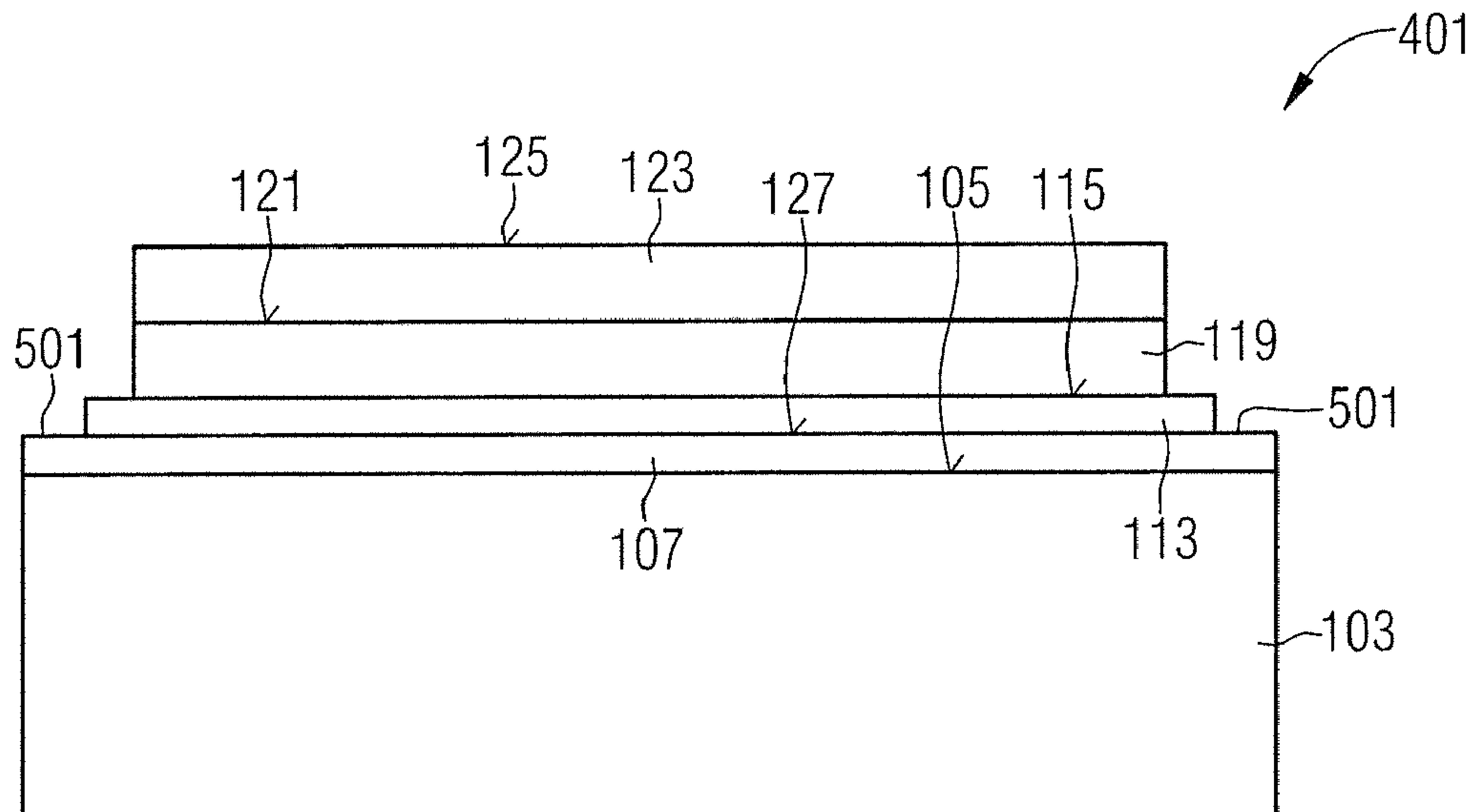
Primary Examiner — Allen L Parker
Assistant Examiner — Gustavo G Ramallo
(74) *Attorney, Agent, or Firm* — DLA Piper LLP (US)

(57) **ABSTRACT**

A carrier for an optoelectronic component includes a main body, wherein the main body includes a first electrically conductive heating layer arrangement, a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body, the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer, and the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement.

20 Claims, 8 Drawing Sheets



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H01L 33/44 (2010.01)
H01L 33/62 (2010.01)

(52) **U.S. Cl.**
CPC *H01L 2224/83234* (2013.01); *H01L 2933/0033* (2013.01); *H01L 2933/0066* (2013.01)

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FIG 1

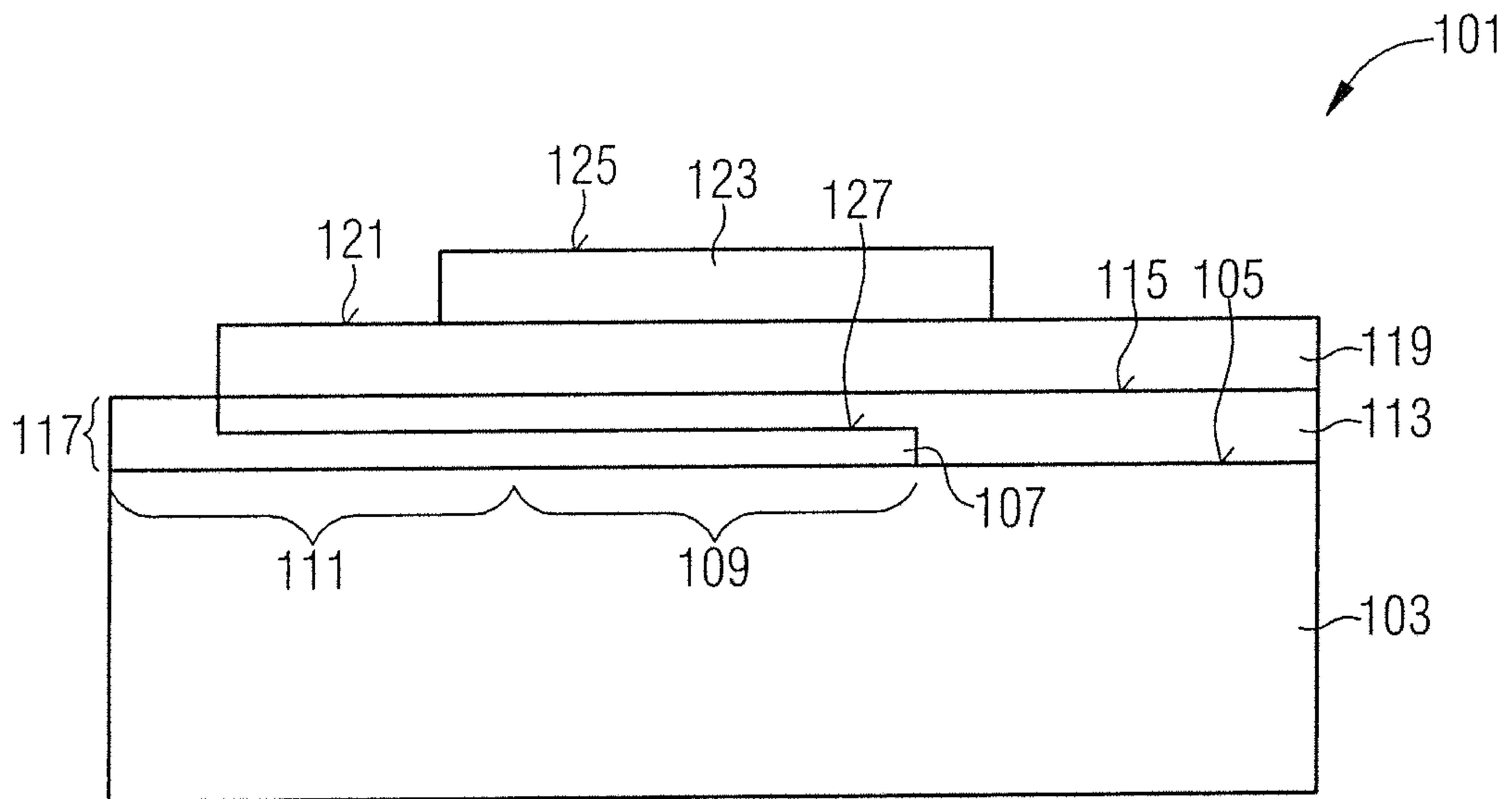


FIG 2

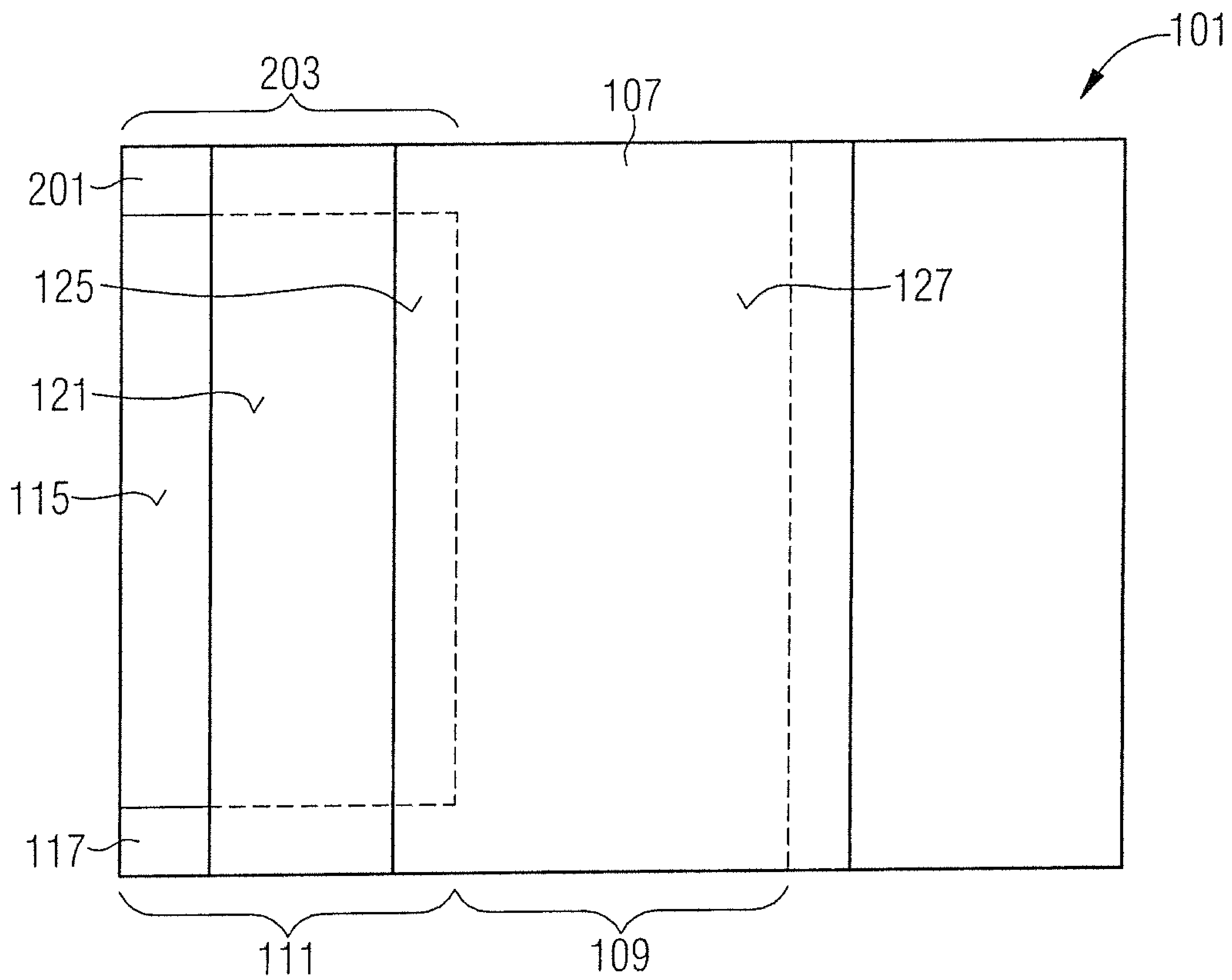


FIG 3

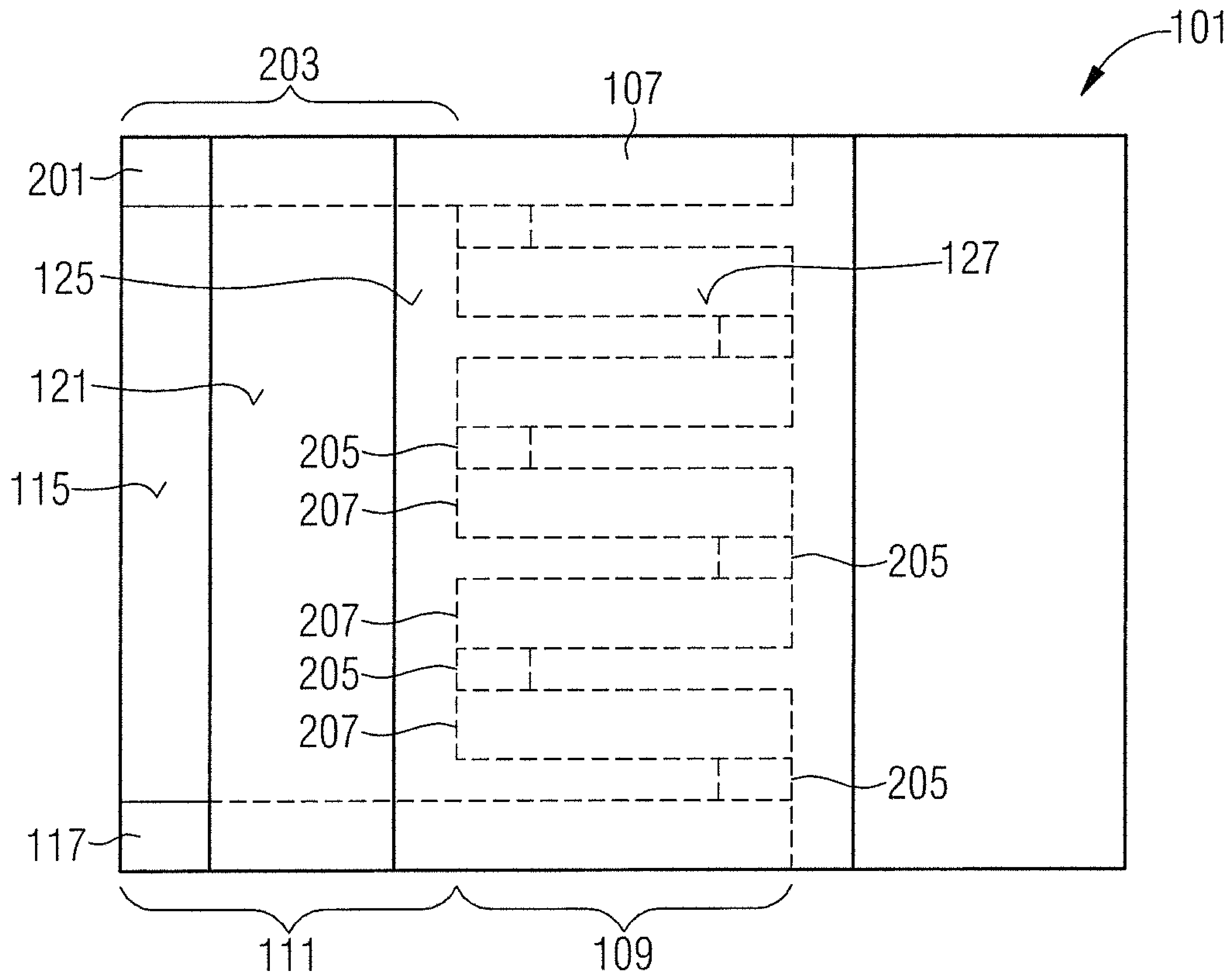


FIG 4

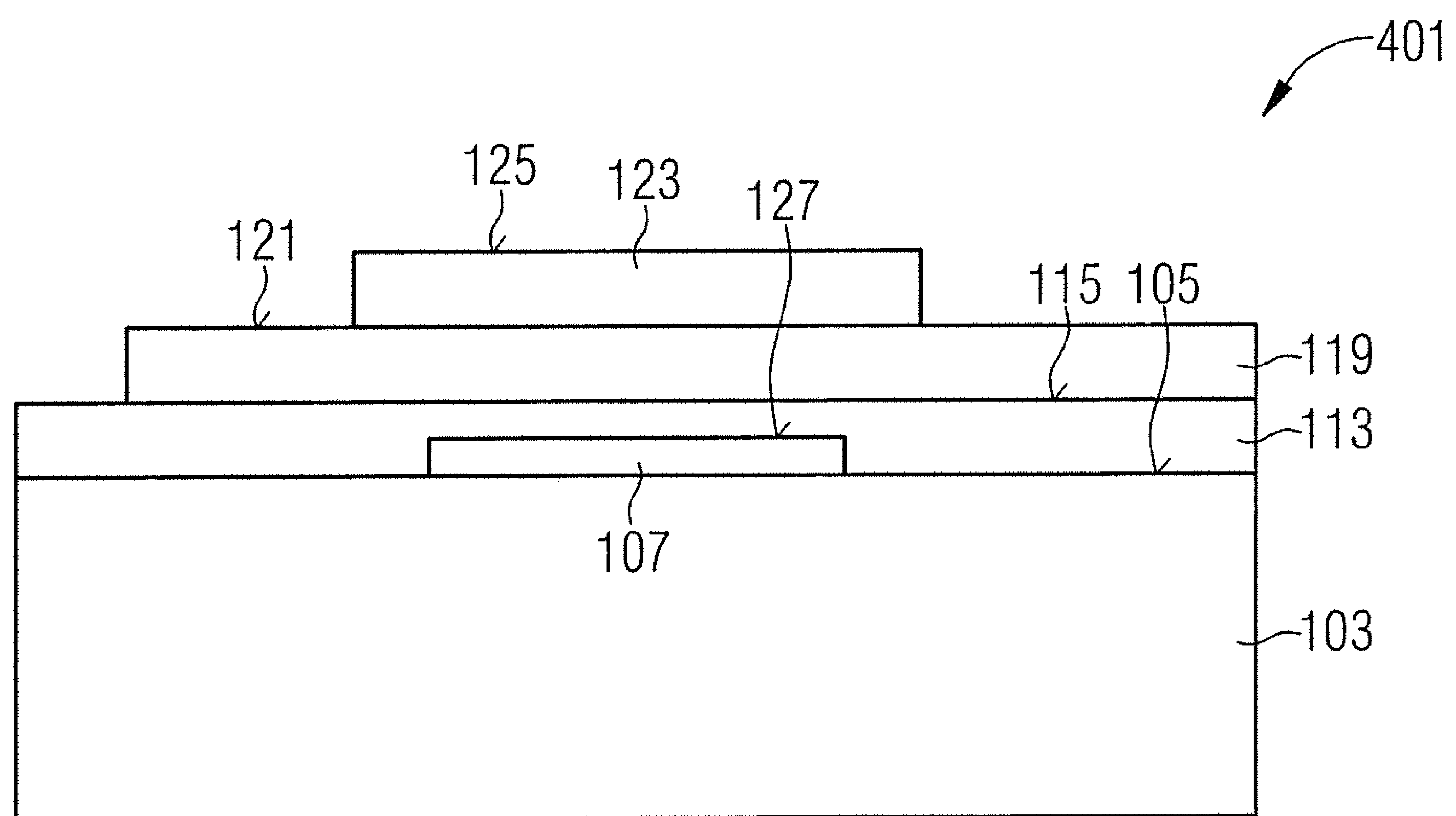


FIG 5

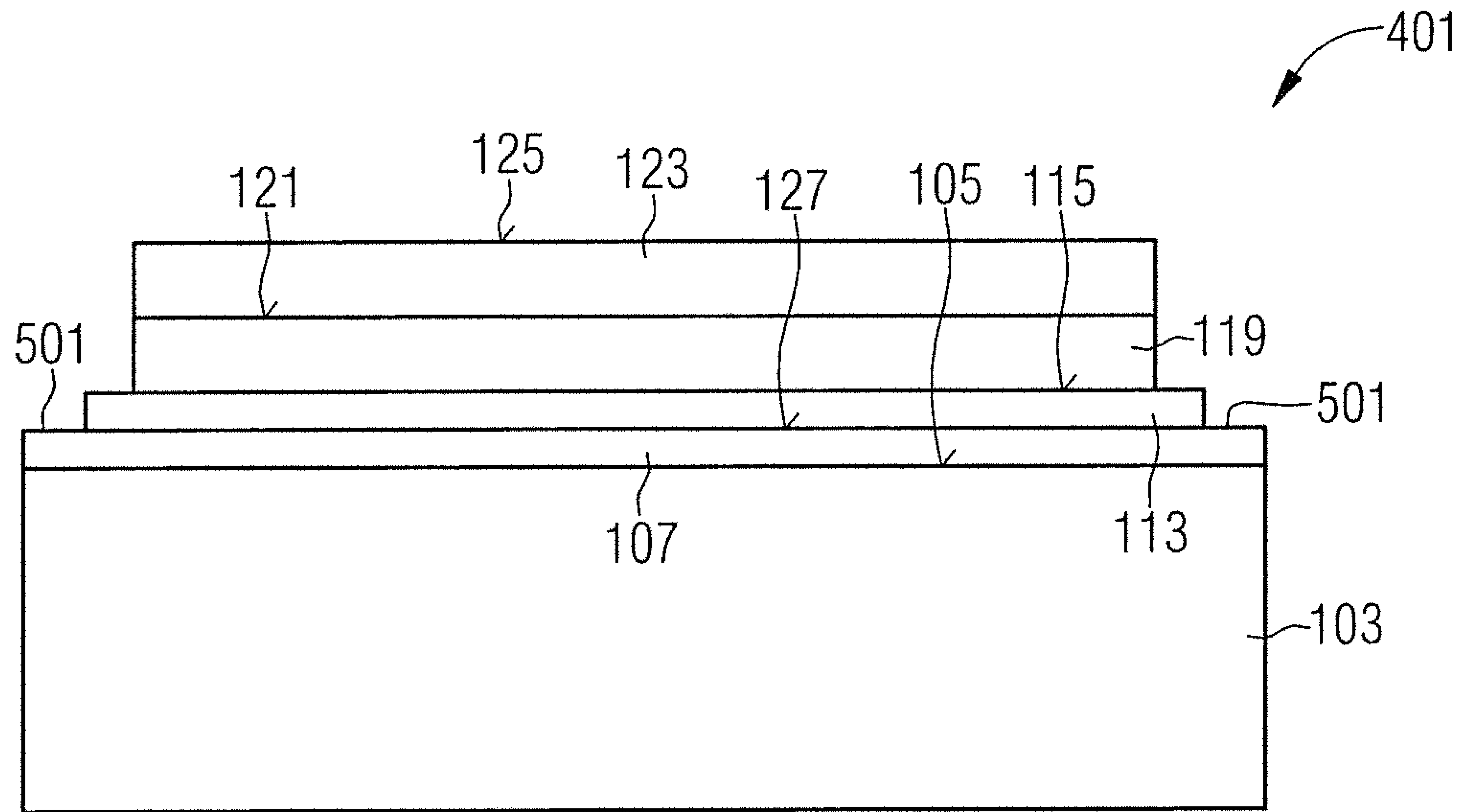
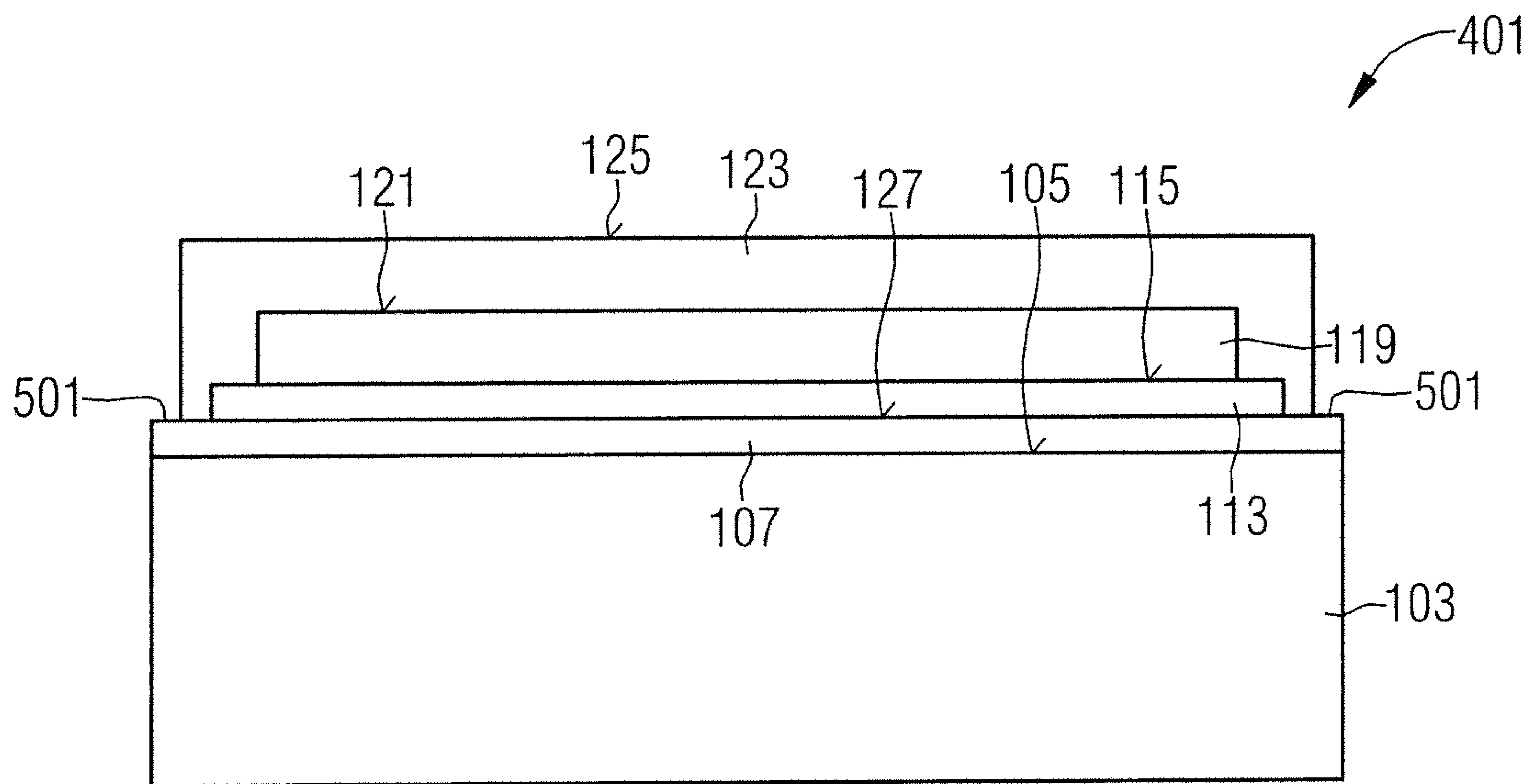


FIG 6



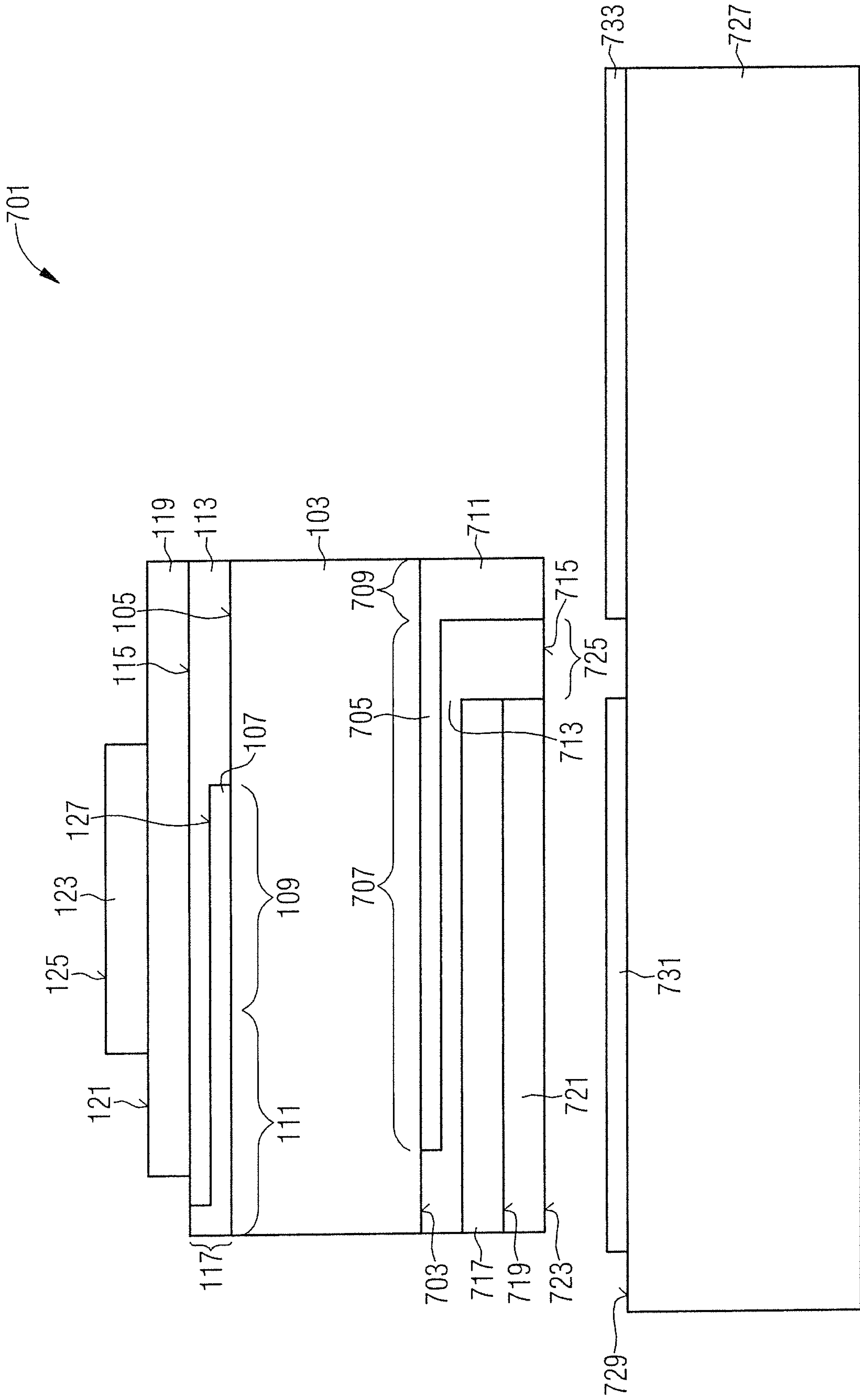


FIG 7
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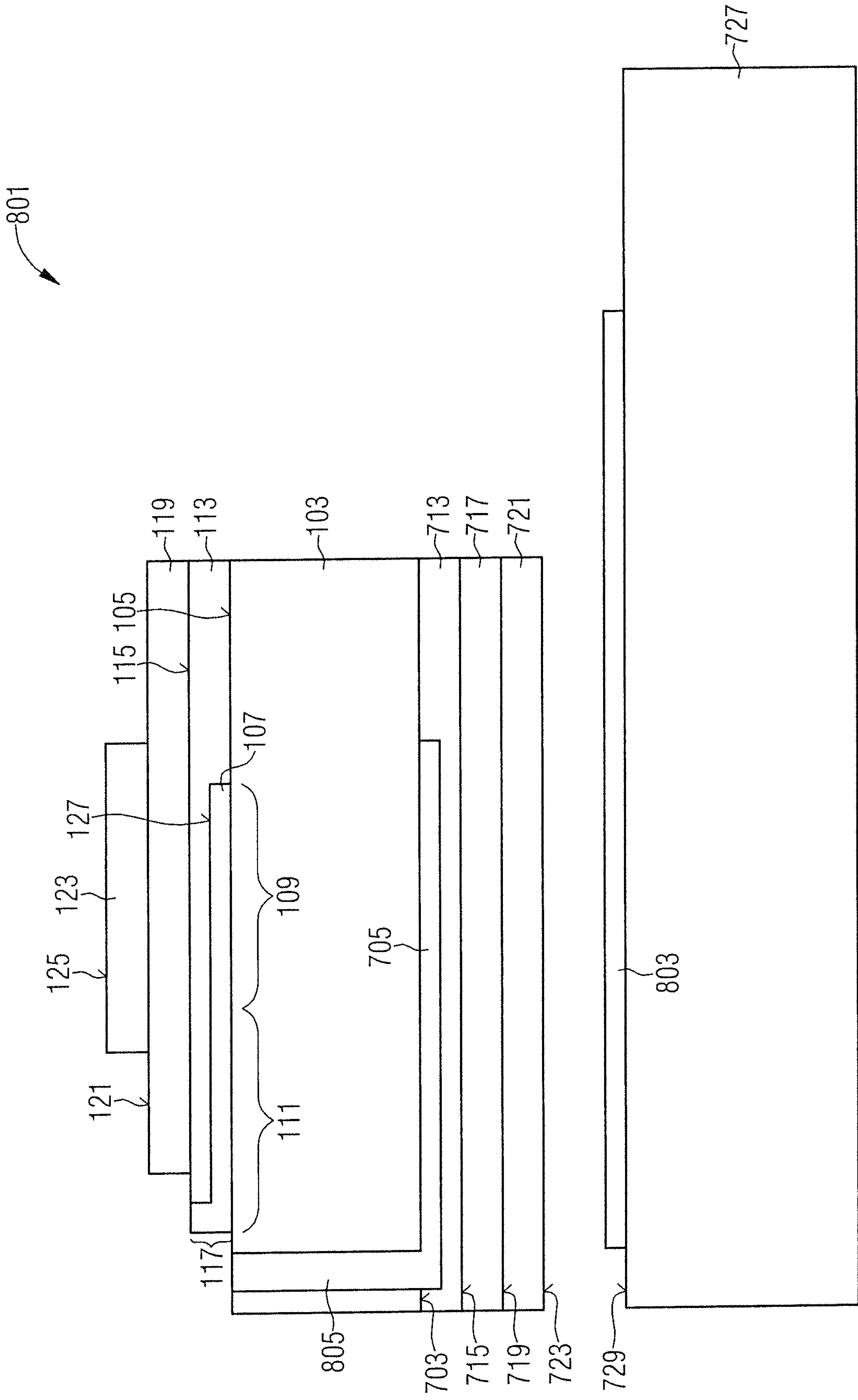
FIG 8
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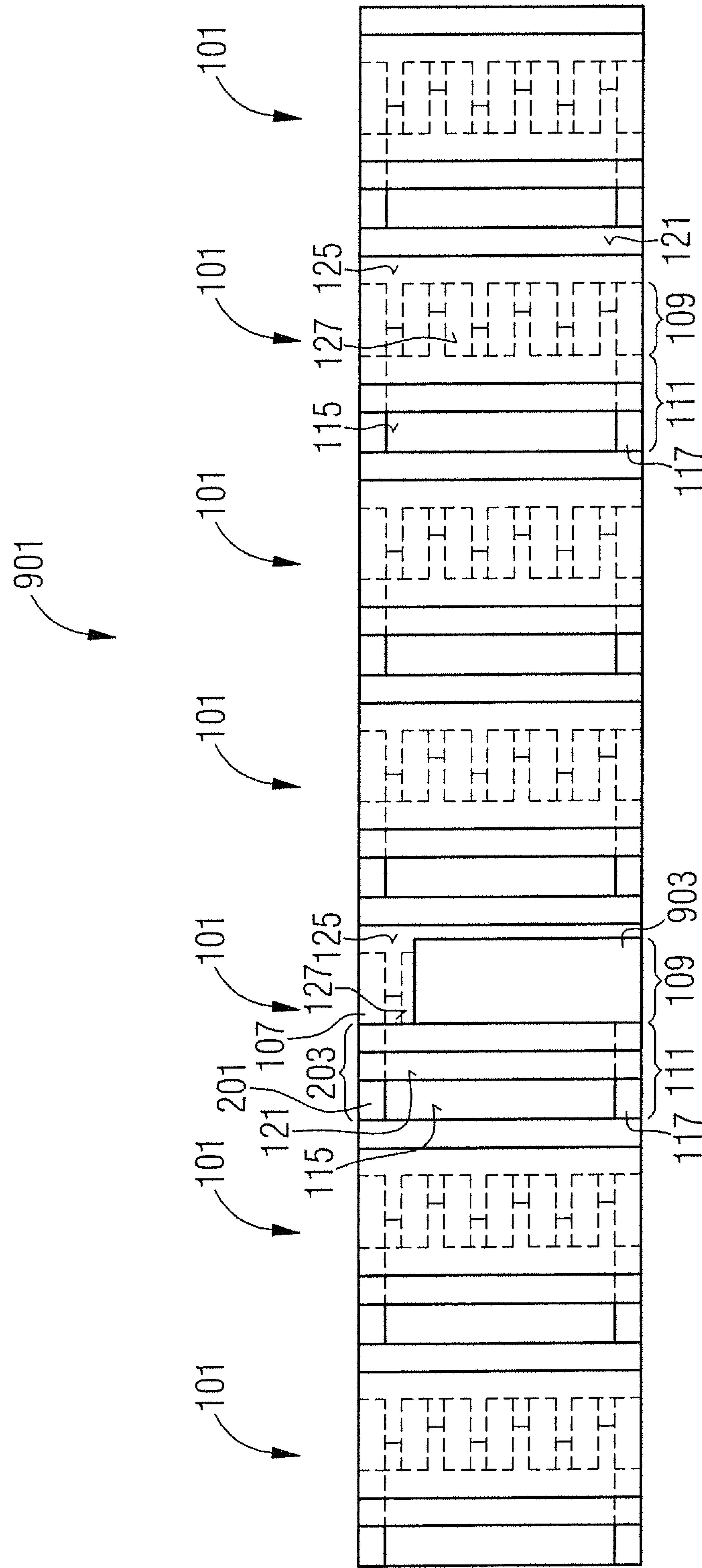

FIG 9
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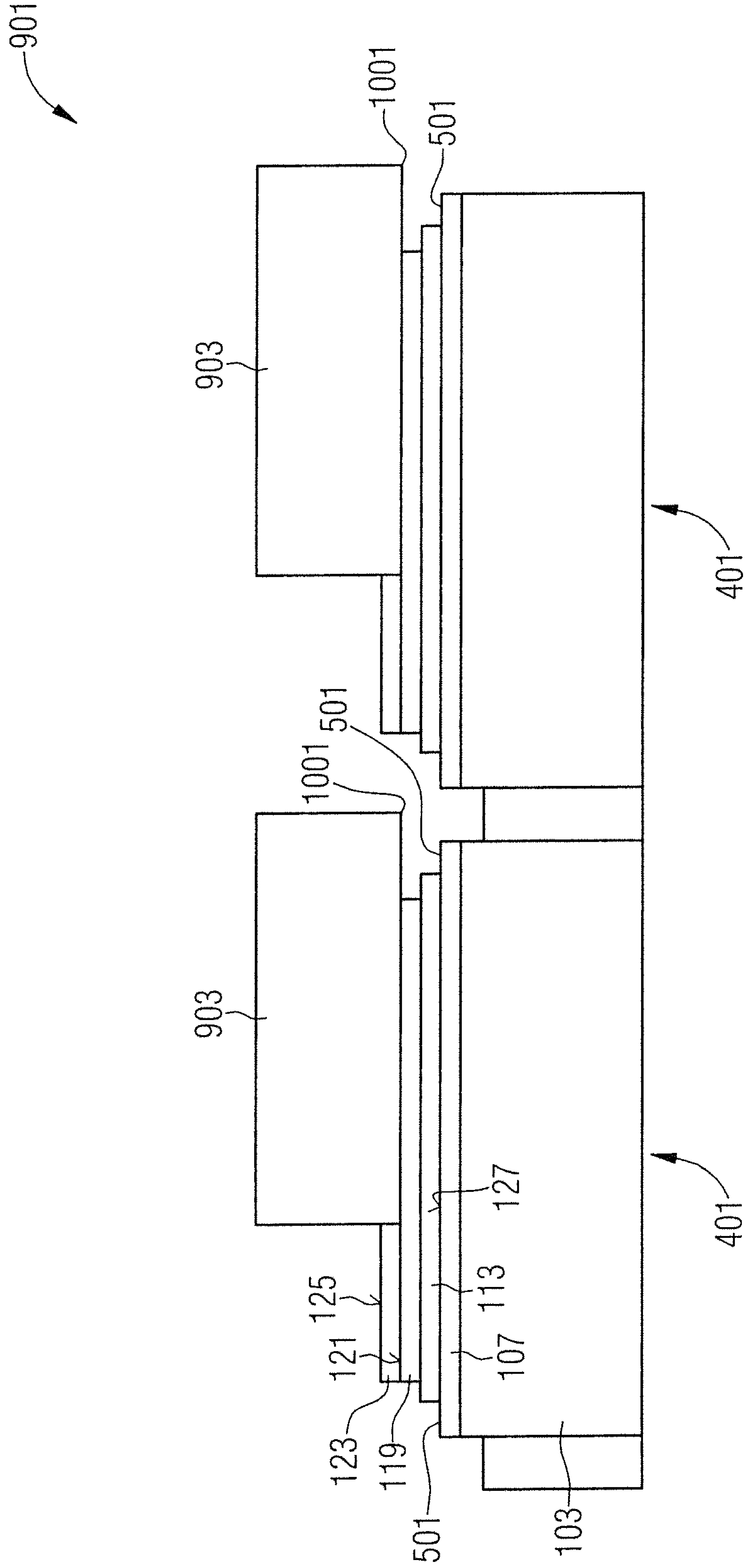


FIG 10

FIG 11

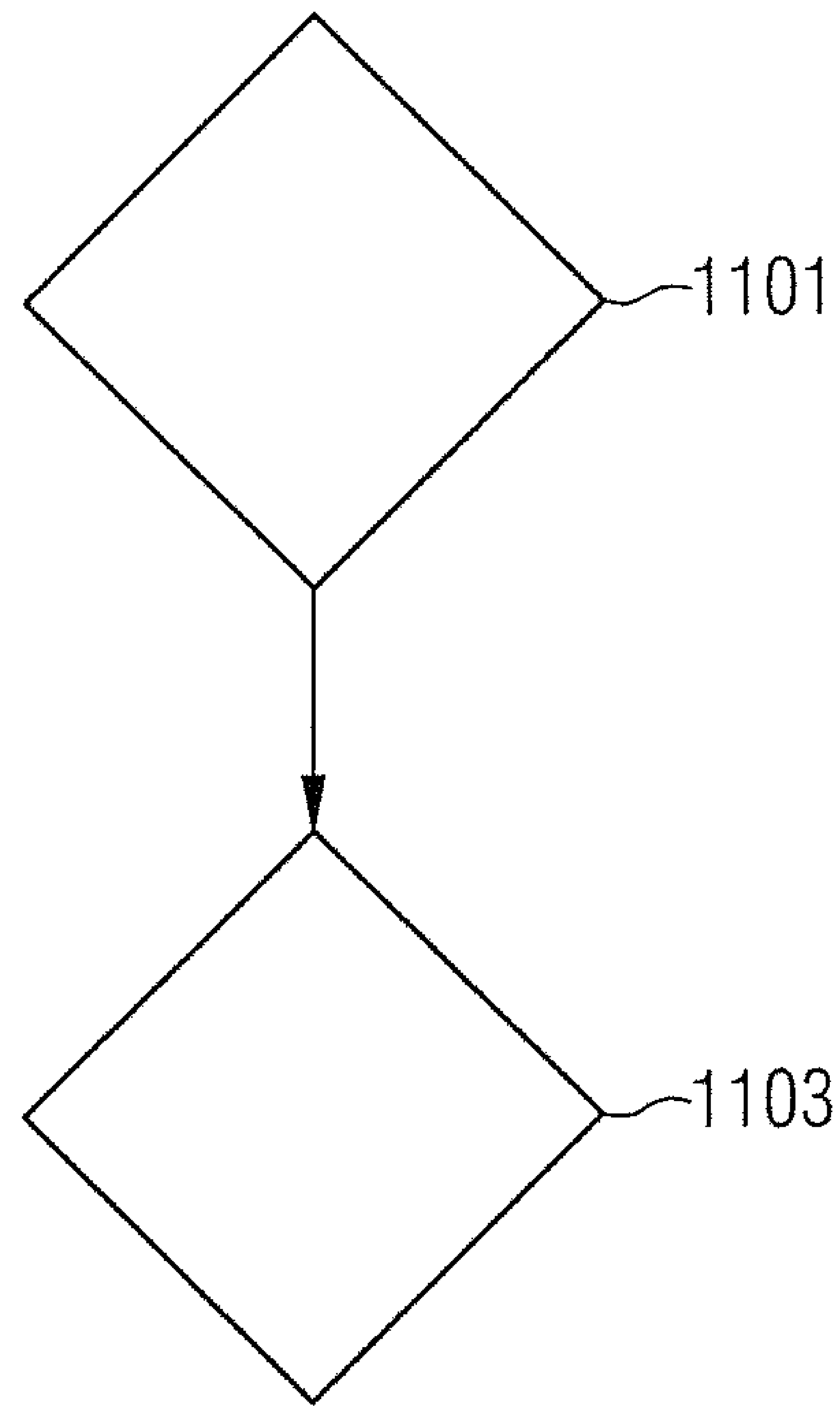
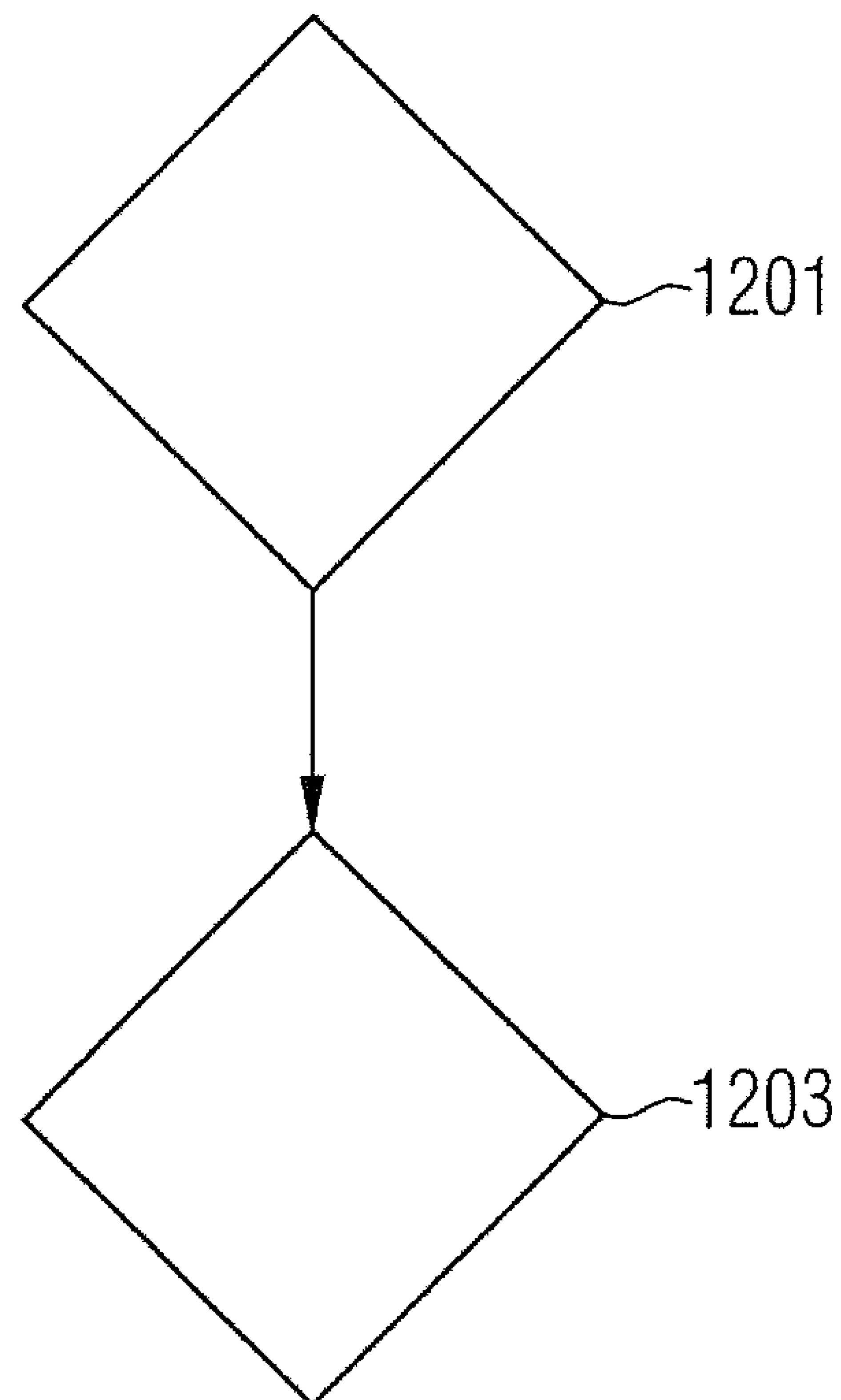


FIG 12



CARRIER FOR AN OPTOELECTRONIC COMPONENT, METHOD OF PRODUCING A CARRIER FOR AN OPTOELECTRONIC COMPONENT, WAFER AND SOLDERING METHOD

TECHNICAL FIELD

This disclosure relates to a carrier for an optoelectronic component, a method of producing a carrier for an optoelectronic component, a wafer, and a soldering method

BACKGROUND

Optoelectronic components are usually soldered onto a carrier. Usually, the component and/or the carrier has a solder layer that has to be heated for soldering purposes. The thermal energy required is provided by a gripping tool or heating plate, for example.

There is thus a need to provide an efficient concept that facilitates efficient soldering of an optoelectronic component onto a main body of a carrier.

SUMMARY

We provide a carrier for an optoelectronic component including a main body, wherein the main body includes a first electrically conductive heating layer arrangement, a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body, the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer, and the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement.

We also provide a method of producing a carrier for an optoelectronic component including providing a main body, wherein the main body includes a first electrically conductive heating layer arrangement, and forming an electrical insulation, a thermal connection and a first solder layer for soldering an optoelectronic component to the main body on a first side of the main body such that the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer.

We further provide a wafer including a plurality of carriers for an optoelectronic component including a main body, wherein the main body includes a first electrically conductive heating layer arrangement, a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body, the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer, and the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement.

We further yet provide a soldering method using a carrier for an optoelectronic component including a main body, wherein the main body includes a first electrically conductive heating layer arrangement, a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body, the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer, and the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement, wherein an optoelectronic component is soldered to the main body by the first solder layer by virtue of the first electrically conductive heating layer arrangement having a voltage or an electric current applied thereto such that the first electrically conductive heating layer arrangement is heated to melt the first solder layer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a first carrier for an optoelectronic component.

FIG. **2** shows a heating portion having a stripe form.

FIG. **3** shows a heating portion having a two-dimensional coil structure.

FIGS. **4** and **5** each show a different view of a second carrier for an optoelectronic component prior to melting the solder layer.

FIG. **6** shows the carrier according to FIGS. **4** and **5** after melting the solder layer.

FIG. **7** shows a third carrier for an optoelectronic component.

FIG. **8** shows a fourth carrier for an optoelectronic component.

FIG. **9** shows a wafer comprising a plurality of carriers for an optoelectronic component.

FIG. **10** shows a wafer comprising a plurality of other carriers for an optoelectronic component.

FIG. **11** shows a flowchart of a method of producing a carrier for an optoelectronic component.

FIG. **12** shows a flowchart of a soldering method.

LIST OF REFERENCE SIGNS

101 Carrier
103 Main body
105 First side of the main body
107 First heating layer arrangement
109 Heating portion of the first heating layer arrangement
111 First contacting portion of the first heating layer arrangement
113 First passivation layer
115 Upper side of the first passivation layer
117 Electric line
119 Further layer arrangement
121 Upper side of the further layer arrangement
123 First solder layer
125 Upper side of the first solder layer
127 Upper side of the first heating layer arrangement
201 Electric line
203 Second electrical contacting portion of the first heating layer arrangement
205 Portion of the two-dimensional coil structure
207 Connecting portion of the two-dimensional coil structure
401 Carrier
501 Exposed portion of the first heating layer arrangement
701 Carrier
703 Second side of the main body
705 Second heating layer arrangement
707 Heating portion of the second heating layer arrangement
709 First contacting portion of the second heating layer arrangement
711 Electric line
713 Second passivation layer

715 Upper side of the second passivation layer
717 Further layer arrangement
719 Upper side of the further layer arrangement
721 Second solder layer
723 Upper side of the second solder layer
725 Portion of the second passivation layer
727 Carrier component
729 Assembly area
731 Electrical contacting area
733 Electrical contacting area
801 Carrier
803 Electrical contacting area
805 Electrical via
901 Wafer
903 Optoelectronic component
1001 Edge
1101 Provision
1103 Formation
1201 Application
1203 Soldering

DETAILED DESCRIPTION

Our carrier for an optoelectronic component may comprise:

a main body,

wherein the main body comprises a first electrically conductive heating layer arrangement,

a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body, and

the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer.

Our method may produce a carrier for an optoelectronic component by the following steps:

providing a main body, wherein the main body comprises a first electrically conductive heating layer arrangement,

forming an electrical insulation, a thermal connection and a first solder layer for soldering an optoelectronic component to the main body on a first side of the main body such that

the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer.

Our wafer may comprise a plurality of carriers.

Our soldering method uses the carrier and/or the wafer, wherein an optoelectronic component is soldered to the main body by the first solder layer by virtue of the first electrically conductive heating layer arrangement having a voltage or an electric current applied thereto such that the first electrically conductive heating layer arrangement heats up to melt the first solder layer.

Each carrier is provided with its own electrically conductive heating layer arrangement. The electrically conductive heating layer arrangement acts as an electrical resistance heater and provides the thermal energy required for soldering. Consequently, what is advantageously brought about on account of the thermal connection between the first solder layer and the first heating layer arrangement is that the thermal energy produced by the first heating layer arrangement can be guided efficiently to the first solder layer. Thus, as a result, the first solder layer advantageously heats up and ultimately melts at an appropriate temperature such that soldering of the optoelectronic component to the main body can be brought about in an efficient manner.

Thus, as a result of the main body comprising a dedicated electrically conductive heating layer arrangement, the thermal energy required for the soldering no longer needs to be provided by way of the gripper tool or a heating plate. Consequently, it is possible to dispense with such a gripper tool or such a heating plate, for example. As a result, it is possible to save costs, for example. In particular, this allows the material outlay to be reduced.

In particular, this allows the thermal energy to be able to be provided to the first solder layer with a higher spatial accuracy to the extent that the thermal energy is produced by the heating layer arrangement comprised of the main body, i.e., situated at a smaller distance from the first solder layer than a heating plate on which the main body is normally placed for soldering purposes.

As a result, increased process reliability can advantageously be brought about on account of thermal energy being introduced directly at, or closer to, the solder interface.

Since consequently, as a rule, the thermal path to the first solder layer is shorter than in known methods for the thermal energy produced, the soldering process will be shorter, as a rule. As a result, it is advantageously possible to avoid temperature-driven damage at the individual elements, for example, in particular at the optoelectronic component.

In particular, an efficient temperature measurement is advantageously facilitated by the electrically conductive heating layer arrangement. This is brought about, in particular, by an electrical characteristic, for example, being predetermined, the characteristic having been measured once in advance, for example. By way of example, such a characteristic specifies the relationship or the dependence of a voltage applied to the heating layer arrangement with/on the temperature of the heating layer arrangement. In particular, the characteristic specifies a relationship or dependence of an electric current that flows through the first heating layer arrangement with/on a temperature of the heating layer arrangement.

That is to say, different voltages are applied to the heating layer arrangement, with the electric current, for example, and/or the temperature of the heating layer arrangement, for example, being measured for each of the applied voltages. Accordingly, it is possible to ascertain a characteristic.

Particularly if the plurality of carriers are comprised of a wafer, i.e., if they are situated in a wafer assemblage, the targeted heating of only a first solder layer of an individual carrier, for example, is advantageously facilitated without the adjacent carriers also being heated in the process.

The phrases "thermally connected" and "thermal connection" define a connection in particular having a thermal conductivity of at least 1 W/(m*K), for example, at least 2 W/(m*K), for example, at least 4 W/(m*K), for example, at least 8 W/(m*K), for example, at least 16 W/(m*K), for example, at least 100 W/(m*K), for example, at least 200 W/(m*K), for example, at least 300 W/(m*K).

By way of example, the main body has a thermal conductivity as listed above in conjunction with the phrases "thermally connected" and "thermal connection." This brings about the technical advantage of, in particular, a heat loss being able to be efficiently dissipated during operation of the optoelectronic component that is soldered onto the main body.

The phrase "electrically connected" means, in particular, "connected in an electrically conductive manner."

The optoelectronic component may be an element from the following group of optoelectronic components: a light-emitting diode (LED), in particular an organic or inorganic

light-emitting diode, a laser diode, a diode chip, an LED chip, a laser diode chip, a laser bar.

The main body may be configured as a submount and it may be referred to as such.

The carrier may be formed from one or more of the following materials and/or comprises one or more of the following materials: AlN, SiC, Si.

The first electrically conductive heating layer arrangement may comprise one or more layers. That is to say, the heating layer arrangement is formed from a plurality of layers, for example. By way of example, the one layer and/or each one of the plurality of layers per se is electrically conductive.

By way of example, the first electrically conductive heating layer arrangement comprises a titanium layer. By way of example, the first electrically conductive heating layer arrangement comprises a platinum layer. By way of example, the first electrically conductive heating layer arrangement comprises a gold layer. By way of example, the first electrically conductive heating layer arrangement comprises a layer stack formed from a titanium layer, a platinum layer and a gold layer.

By way of example, the titanium layer, as first layer of the layer stack, may be arranged on the first side of the main body. By way of example, the platinum layer, as the second layer of the layer stack, may be applied to, or arranged on, the titanium layer. By way of example, the gold layer, as a third layer of the layer stack, may be arranged on the second layer, i.e., the platinum layer.

A thickness of the first electrically conductive heating layer arrangement is 15 nm to 200 nm, for example.

The titanium layer advantageously brings about an efficient adhesion of the subsequent platinum layer on the main body, i.e., on the first side of the main body. The platinum layer advantageously brings about the possibility of an efficient prevention of a diffusion of gold atoms from the gold layer into the main body.

The first side of the main body may be formed as an upper side of the main body. That means that the first side of the main body is the upper side of the main body, for example.

The carrier may comprise an optoelectronic component, wherein the optoelectronic component is soldered onto the main body or soldered with the main body by the first solder layer.

The first heating layer arrangement may be electrically insulated from the first solder layer by a first electrically insulating passivation layer by virtue of the first passivation layer being arranged at least in part on the first heating layer arrangement, wherein the first solder layer is arranged at least indirectly on the first passivation layer.

In particular, this brings about the technical advantage of being able to produce an efficient electrical insulation. This is true, in particular, because the passivation layer can be efficiently produced by processes known per se and can be applied to the first side of the main body.

The first passivation layer may have a thickness of 10 nm to 200 nm.

The phrasing that the first solder layer is arranged at least indirectly on the first passivation layer means that, for example, the first solder layer is not arranged, directly but indirectly on the first passivation layer. That is to say that in the indirect arrangement, at least one further layer is still provided between the first solder layer and the passivation layer. By way of example, a layer stack formed from a titanium layer, a platinum layer and a gold layer is provided between the first solder layer and the first passivation layer. By way of example, a titanium layer may be directly applied to, or arranged on, the first passivation layer. By way of example, a platinum layer is arranged on, or applied to, the titanium layer. By way of example, a gold layer is arranged on, or applied to, the platinum layer. By way of example, the first solder layer is arranged on, or applied to, the gold layer. By way of example, the thickness of this layer stack is 500 nm to 600 nm.

The first solder layer may be an AuSn-layer. That is to say that the first solder layer is formed from AuSn, for example.

A thickness of the first solder layer is 0.5 μm to 3.5 μm, for example.

The technical effects and advantages for the layer stack situated between the first solder layer and the passivation layer should be seen to be analogous, in particular, to the technical advantages of the titanium/platinum/gold layer stack of the first electrically conductive heating layer arrangement. Thus, the titanium layer facilitates an efficient adhesion of the solder layer, for example. Consequently, the platinum layer, for example, prevents gold from the first solder layer from diffusing into the passivation layer. The gold layer advantageously likewise brings about an efficient adhesion of the first solder layer.

An electric line may extend from an upper side, facing away from the first side of the main body, of the first passivation layer to the first heating layer arrangement through the first passivation layer to be formed for the purposes of electrically contacting the first heating layer arrangement. That is to say that, an electric line is formed for the purposes of electrically contacting the first heating layer arrangement, wherein the electric line extends from an upper side, facing away from the first side of the main body, of the first passivation layer to the first heating layer arrangement through the first passivation layer. Thus, the electric line extends from an upper side of the first passivation layer to the first heating layer arrangement through the first passivation layer. The upper side of the first passivation layer faces away from the first side of the main body. Thus, the electric line electrically contacts the first heating layer arrangement; i.e., it is connected in an electrically conductive manner to the latter. By way of example, this electric line can be referred to as a first electric line.

In particular, this brings about the technical advantage of being able to bring about efficient electrical contacting of the first heating layer arrangement.

The electric line may be formed by the first heating layer arrangement.

In particular, this brings about the technical advantage of being able to produce the electric line efficiently. This is because, for example, the first heating layer arrangement may already be configured such that it comprises a portion which, after formation of the passivation layer, extends through the latter. That is to say that the first heating layer arrangement is and/or has been structured such that, for example, the electric line extends through the passivation layer, as described above, after an application of the passivation layer.

The first heating layer arrangement may have a first electrical contacting portion, a second electrical contacting portion and a heating portion extending between the first solder layer and the first side, wherein the heating portion of the first heating layer arrangement is electrically contacted by the two electrical contacting portions of the first heating layer arrangement.

In particular, this brings about the technical advantage of being able to efficiently heat the first solder layer. This is because efficient local heating of the solder layer can be

brought about by the heating portion being situated between the solder layer and the first side of the main body.

The heating portion of the first heating layer arrangement may have a stripe form or a two-dimensional coil structure.

The stripe form advantageously allows the heating portion to be produced in an efficient and simple manner.

In particular, a two-dimensional coil structure for the heating portion brings about the technical advantage of being able to bring about efficient electric current guidance, provided lateral transverse resistances are smaller in comparison with a stripe form.

The phrasing "two-dimensional" in conjunction with the coil structure means that, in particular, the corresponding heating portion extends in a real fashion in a plane.

The first heating layer arrangement may have an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement.

This brings about the technical advantage of, in particular, a self-regulating soldering process being facilitated. This is because the solder, when it melts, will run on the exposed portion and as a result thereof, i.e., as a result of the electrical contact arising in that case, it will reduce an electrical resistance of the first heating layer arrangement. A reduction in the electrical resistance of the first heating layer arrangement advantageously brings about a reduction in the electrical heat loss, and so the temperature drops or becomes lower as a result thereof. Consequently, this advantageously prevents the temperature of the solder rising above a temperature that is critical to the optoelectronic component.

Further, this brings about the technical effect of, for example, the melting temperature of the solder only being maintained until the solder has flowed onto the exposed portion. That is to say, the optoelectronic component is only exposed to the melting temperature during this time interval. As a result, this can avoid damage to the component due to heat, for example.

Thus, this means that, for example, too strong heating of the first solder layer can be efficiently avoided. Too strong means that, in particular, a temperature that lies more than 20% above the melting temperature of the solder layer is reached.

Thus, this can advantageously avoid heat damage to the individual elements of the carrier and, in particular, to the component.

A second electrically conductive heating layer arrangement may be arranged on a second side of the main body, lying opposite the first side, wherein the second heating arrangement is electrically insulated from a second solder layer arranged on the second side and thermally connected to the second solder layer.

This brings about the technical advantage of, in particular, the carrier itself being able to be soldered on or soldered with a second or further carrier, for example.

The main body may be soldered onto a further carrier by the second solder layer by virtue of the second electrically conductive heating layer arrangement having a voltage or an electric current applied thereto such that the second electrically conductive heating layer arrangement heats up to melt the second solder layer. The further carrier may also be referred to as a carrier component.

The second side of the main body may be formed as a lower side of the main body. That is to say that, for example, the second side of the main body is the lower side of the main body.

Technical features and technical properties of the second heating layer arrangement emerge in analogous fashion to the technical properties and technical features of the first heating layer arrangement, for example. That is to say that the explanations given in conjunction with the first heating layer arrangement apply analogously to the second heating layer arrangement, and vice versa. Therefore, reference is made to the explanations correspondingly given for the purposes of avoiding repetition.

The second heating layer arrangement may be electrically insulated from the second solder layer by a second electrically insulating passivation layer by virtue of the second passivation layer being arranged at least in part on the second heating layer arrangement, wherein the second solder layer is arranged at least indirectly on the second passivation layer.

The technical advantages that emerge from the example comprising the second passivation layer should be considered to be analogous to the technical advantages as emerge in conjunction with examples comprising the first passivation layer. Reference is made to the explanations correspondingly given for the purposes of avoiding repetition.

Technical features and technical properties of the second passivation layer emerge analogously from the technical features and technical properties of the first passivation layer. That is to say, the second passivation layer can have properties and technical features as described in conjunction with the first passivation layer.

An electric line extending from an upper side, facing away from the second side of the main body, of the second passivation layer to the second heating layer arrangement through the second passivation layer may be formed for the purpose of electrically contacting the second heating layer arrangement. That is to say that, an electric line may be formed for the purpose of electrically contacting the second heating layer arrangement, wherein the electric line extends from an upper side, facing away from the second side of the main body, of the second passivation layer to the second heating layer arrangement through the second passivation layer. Thus, the electric line extends from an upper side of the second passivation layer to the second heating layer arrangement through the second passivation layer. The upper side of the second passivation layer faces away from the second side of the main body. Thus, the electric line electrically contacts the second heating layer arrangement; i.e., it is connected in an electrically conductive manner to the latter. By way of example, this electric line can be referred to as a second electric line.

In particular, this brings about the technical advantage of being able to bring about efficient electrical contacting of the second heating layer arrangement.

The electric line may be formed by the second heating layer arrangement.

The technical advantages emerging therefrom should be considered to be analogous to the technical advantages as have emerged in conjunction with the example in which the electric line is formed by the first heating layer arrangement. Reference is made to the explanations correspondingly given for the purposes of avoiding repetitions.

The second heating layer arrangement may have a first electrical contacting portion, a second electrical contacting portion and a heating portion extending between the second solder layer and the second side, wherein the heating portion of the second heating layer arrangement is electrically contacted by the two electrical contacting portions of the second heating layer arrangement.

Here, too, the technical advantages should be considered to be analogous to the technical advantages specified above, as have emerged in conjunction with the first heating layer

arrangement comprising the first and the second electrical contacting portion and the first and the second electrical contacting portion and the heating portion.

The heating portion of the second heating layer arrangement may have a stripe form or a two-dimensional coil structure.

The corresponding advantages emerge analogously to the advantages of the example according to which the heating portion of the first heating layer arrangement has a stripe form or a two-dimensional coil structure.

The second heating layer arrangement may be electrically contacted by an electrical via extending from the first side to the second side of the main body.

In particular, this brings about the technical advantage of being able to electrically contact the second heating layer arrangement efficiently. That is to say that the second heating layer arrangement is and/or has been electrically contacted from the first side, i.e., from the upper side of the main body, for example.

The carrier may be and/or have been produced by the method of producing a carrier for an optoelectronic component.

The carrier may be produced by the method of producing a carrier for an optoelectronic component.

Technical functionalities of the method of producing a carrier for an optoelectronic component emerge in analogous fashion from the corresponding technical functionalities of the carrier for an optoelectronic component, and vice versa. That is to say that method features of the method of producing a carrier for an optoelectronic component emerge from corresponding apparatus features of the carrier for an optoelectronic component, and vice versa.

The electrically conductive heating layer arrangement, i.e., the first and/or the second heating layer arrangement in particular, may be and/or have been produced by a vapor deposition process and/or electrolytic process.

That is to say that layers, i.e., layers of the heating layer arrangement, first and/or second solder layer, first and/or second passivation layer, for example, are vapor deposited layers and/or electrolytically applied or electrodeposited layers.

The phrase "and/or" comprises, in particular, alternatively the phrase "and" or the phrase "or."

The main body may be soldered onto a further carrier by the second solder layer.

The technical advantage brought about by vapor deposition processes and electrodeposition processes is that, in particular, the individual layers can be produced efficiently using process methods known per se.

The first and/or second heating layer arrangement may be and/or are integrated in the main body.

The main body may be configured as a submount and/or may be a submount. A submount advantageously serves for efficient handling and/or as an efficient thermal conductor and/or for an efficient thermal spread and/or for an efficient compensation of different thermal expansions. That is to say, in particular, that a submount is configured, in particular, for handling and/or for thermal conduction and/or for a thermal spread and/or for a compensation of different thermal expansions.

That is to say that, in particular, the main body and/or the submount is formed as a thermal conductor, for example. In particular, the main body and/or the submount is formed to compensate different thermal expansions.

The above-described properties, features and advantages and the manner in which they are achieved will become clearer and more easily understandable in conjunction with the following description of the examples, explained in more detail in conjunction with the drawings.

Below, the same reference signs can be used for the same features. Moreover, for purposes of a better overview, not all elements in all drawings always have a reference sign.

FIG. **1** shows a carrier **101** for an optoelectronic component in a front view.

No optoelectronic component has been shown for reasons of clarity.

The carrier **101** comprises a main body **103**. The main body **103** is configured as a submount, for example. By way of example, the main body **103** is formed from one or more of the following materials and/or comprises one or more of the following materials: AlN, SiC, Si.

The main body **103** has a first side **105**. By way of example, the first side **105** is the upper side of the main body **103**.

A first electrically conductive heating layer arrangement **107** is applied or arranged on the first side **105**. By way of example, the first heating layer arrangement **107** has been deposited on the first side **105** by an electrodeposition method. By way of example, the first heating layer arrangement **107** has been vapor deposited on the first side **105** by a vapor deposition method.

Moreover, the main body **103** comprises a first passivation layer **113** applied to both an upper side **127** of the first heating layer arrangement **107** and the first side **105** of the main body **103**. By way of example, the passivation layer **113** has been deposited on the first side **105** and on the upper side **127** by an electrodeposition method. By way of example, the passivation layer **113** has been vapor deposited.

The first heating layer arrangement **107** has been structured such that it has a heating portion **109** and two electrical contacting portions. Only the first contacting portion is illustrated as FIG. **1** shows a front view of the carrier **101**, with the first electrical contacting portion being denoted by curly braces with the reference sign **111**.

The first electrical contacting portion **111** consequently contacts the heating portion **109**.

Further, an electric line **117** extends from an upper side **115** of the first passivation layer **113** to the first contacting portion **111**. Consequently, the first contacting portion **111** can thus be electrically contacted from the upper side **115** of the passivation layer **113** by the electric line **117**.

By way of example, the electric line **117** is formed by the first heating layer arrangement **107**. That is to say that the first heating layer arrangement **107** is structured such that the latter has the electric line **117**. Consequently, the passivation layer **113** can be vapor deposited or deposited after formation of the first heating layer arrangement **107** such that a passivation layer forms automatically, the electric line **117** extending therethrough from the upper side of the passivation layer **113** to the first contacting portion **111** of the first heating layer arrangement **107**.

By way of example, the first heating layer arrangement **107** is formed as a layer stack. By way of example, the layer stack comprises the following three layers: a titanium layer, a platinum layer, a gold layer. By way of example, as seen from the main body **103**, the titanium layer is arranged first on the first side **105**. The platinum layer is arranged on the titanium layer. The gold layer is arranged on the platinum layer.

By way of example, the passivation layer comprises one or more of the following materials and/or is formed from one or more of the following materials:

A further layer arrangement **119** is arranged on the upper side **115** of the first passivation layer **113**. By way of

example, the further layer arrangement **119** is vapor deposited or deposited. The further layer arrangement **119** comprises a titanium layer, a platinum layer and a gold layer, for example. By way of example, the titanium layer of the further layer arrangement **119** has been arranged as a first layer on the upper side **115** of the first passivation layer **113**. By way of example, the platinum layer follows as a second layer and the gold layer, for example, follows as third layer.

A first solder layer **123** is arranged on an upper side **121** of the further layer arrangement **119**. The first solder layer **123** has been vapor deposited or deposited, for example. The first solder layer **123** has an upper side **125**. An optoelectronic component may be arranged on the upper side **125** of the first solder layer **123** to solder the optoelectronic component onto the main body **103**, i.e., onto the first side **105**.

By way of example, the solder layer **123** is formed as an AuSn layer.

Thus, the heating portions **109** is arranged between the first **105** side of the main body **103** and the solder layer **123**.

Thermal energy must be supplied to the first solder layer **123** to melt the solder layer **123**. The first heating layer arrangement **107** is provided to this end. The latter is electrically contacted by way of its two contacting portions such that an electric current flows through the first heating layer arrangement **107**. Since the first heating layer arrangement **107** has an ohmic resistance, the first heating layer arrangement **107** acts as an ohmic resistance heater and consequently produces thermal energy.

On account of the employed materials for the individual layers, a thermal connection is first formed between the first heating layer arrangement **107** and the first solder layer **123**. Thermal energy can be efficiently supplied to the first solder layer **123** by this thermal connection, the thermal energy having been produced by the first heating layer arrangement **107**.

The first heating layer arrangement **107** is electrically insulated from the first solder layer **123** on account of the passivation layer **113**. The passivation layer **113** also insulates the first heating layer arrangement **107** from the further layer arrangement **119**. In general, the first heating layer arrangement **107** is electrically insulated from further metallizations of the main body **103**, in particular.

By way of example, the heating portion **109** has a stripe form or a two-dimensional coil structure.

FIG. **2** shows the carrier **101** according to FIG. **1** in a view from above on the first side **105**, wherein the heating portion **109** of the first heating layer arrangement **107** may have a stripe form.

In the view from above, it is now possible to also identify the second electrical contacting portion **203** and an electric line **201**, extending in a manner analogous to the electric line **117** from the upper side **115** of the passivation layer **113** to the second electrical contacting portion **203**. The explanations given in conjunction with the electric line **117** apply analogously to the electric line **201**.

FIG. **3** shows a view from above on the carrier **101** of FIG. **1**, wherein the heating portion **109** has a two-dimensional coil structure according to a further example. The coil structure comprises a plurality of portions **205**, **207**. The portions **205** are laterally offset from one another in relation to a longitudinal axis of the main body **103**, wherein the portions **205** laterally offset from one another are each connected to one another by a connection portion **207**.

FIG. **4** shows a front view of a second carrier **401** for an optoelectronic component.

The second carrier **401** is formed in a substantially analogous manner to the first carrier **101**. Reference is made to the corresponding explanations. FIG. **5**, which shows a side view of the second carrier **401** according to FIG. **4**, shows a difference.

The first heating layer arrangement **107** has two opposing exposed portions **501** provided at the edge of the first side **105**. That is to say, the passivation layer **113** does not cover the entire area of the first heating layer arrangement **107**, but still leaves the second portions **501** exposed. Consequently, an open step structure is created—the exposed portions **501**.

When the solder layer **123** melts, molten solder flows on the exposed portions **501** of the first heating layer arrangement **107**. Thus, the molten solder establishes an electrical connection to the first heating layer arrangement **107**, for example, to the gold layer. This brings about the technical effect of reducing an electrical resistance of the first heating layer arrangement **107**, and correspondingly reduces a heat influx into the first heating layer arrangement **107**. This advantageously facilitates a self-regulating soldering process.

FIGS. **1** to **6** illustrate carriers only having a first heating layer arrangement on the first side **105**. Consequently, the carriers have a one-sided structure. By way of example, these carriers can be referred to as carriers structured on one side.

By contrast, FIGS. **7** and **8** show a two-sided structure of the carrier, i.e., carriers structured on two sides in the sense that a second heating layer arrangement is arranged on a second side of the main body in that case, with the second side lying opposite the first side. This will be explained in more detail below.

FIG. **7** shows a third carrier **701** in a front view.

The first side **105** of the main body **103** is structured in a manner analogous to the carrier **101** according to FIG. **1**. Reference is made to the explanations made accordingly.

A second side **703** of the main body **103** is likewise structured, with the second side **703** lying opposite the first side **105**. In general, structured means that a layer structure has been applied to the corresponding side.

The second side **703** is provided with a second electrically conductive heating layer arrangement **705**. Explanations that were given in conjunction with the first heating layer arrangement **107** apply to the second heating layer arrangement **705**, in particular in an analogous fashion. Accordingly, the second heating layer arrangement **705** has a heating portion **707** and a first contacting portion **709** and a second contacting portion, which cannot be seen on account of the front view. The second contacting portion is electrically contacted in a manner analogous to the first contacting portion **709** by a line formed in an analogous fashion to the line **711**.

The two heating portions **109** and **707** each lie between the first and/or second side of the main body **103** and the corresponding solder layer.

Accordingly, an electric line **711** extends from an upper side **715** of a second passivation layer **713** to the first contacting portion **709** of the second heating layer arrangement **705**.

In a manner analogous to the first side **105**, the second side **703** provides a second further layer arrangement **717** and a second solder layer **721**. The second further layer arrangement **717** is at least partly applied to the second passivation layer **713**. The second solder layer **721** is arranged on second this further layer arrangement **717**, namely on an upper side **719** of the further layer arrangement **717**.

Explanations given in conjunction with the first solder layer **123** and/or with the further layer arrangement **119**

apply analogously to the further layer arrangement **717** and to the second solder layer **721**. In particular, the second further layer arrangement **717** also can be referred to as further layer arrangement for reasons of simplicity.

The second passivation layer **713** has a portion denoted by curly braces with the reference sign **725**, the portion electrically insulating the further layer arrangement **717** and the second solder layer **721** from the electric line **711**. The upper side **715** of the portion **725** of the second passivation layer **713** and an upper side **723** of the second solder layer **721** and an upper side of the electric line **711** extend flush with one another.

A carrier component **727** has an assembly area **729**. Two electrical contacting areas **731**, **733** are arranged on the assembly area **729** at a distance from one another and electrically insulated from one another. The distance between the two contacting areas **731** and **733** substantially corresponds to a width of the portion **725**, i.e., a distance between the second solder layer **721** and the electric line **711**. A third electrical contacting area is arranged on the assembly area **729**. However, it is not visible on account of the front view. The third electrical contacting area is arranged at a distance from and electrically insulated in relation to the two electrical contacting areas **731**, **733** on the assembly area **729**.

The carrier **701**, more precisely the main body **703**, is arranged on the assembly area **729** with the second side **703**, which is formed as the lower side of the main body **103**, for example. This is performed such that the electrical contacting area **731** contacts the second solder layer **721**. The electrical contacting area **733** contacts the electric line **711**. The third electrical contacting area, not visible here, contacts the second contacting portion (likewise not visible) of the second heating layer arrangement **705**.

Consequently, a power supply to the second solder layer **721** is facilitated via the electrical contacting areas **731**. Consequently, a power supply to the line **711** and to the line, which contacts the second contacting portion, is facilitated via the electrical contacting area **733** and via the third electrical contacting area.

The second heating layer arrangement **705** produces thermal energy in a manner analogous to the first heating layer arrangement **107** to supply the thermal energy to the second solder layer **721** to melt the latter.

FIG. **8** shows a fourth carrier **801** in a front view.

A two-sided structure is also provided in the fourth carrier **801** for an optoelectronic component. That is to say that a layer structure has also been provided on the second side **703** of the main body **103**.

According to the example shown in FIG. **8**, the passivation layer **713** completely covers the second heating layer arrangement **705**. The further layer arrangement **717** is applied to the upper side **715** of the second passivation layer **713**, with the second solder layer **721** in that case being applied to the upper side **719** of the further layer arrangement **717**.

Electrical contacting of the second heating layer arrangement **705** is formed by way of two vias, with only one of the two vias being visible on account of the front view. This one electrical via is provided with reference sign **805**.

The electrical via **805** extends through the main body **103** from the first side **105** to the second side **703** of the main body **103**. That is to say that the second heating layer arrangement **705** is contacted from the first side **105** of the main body **103**.

Consequently, the electrical contacting areas of the assembly area **729** of the carrier component **727** for electrical contacting of the corresponding contacting portions of the second heating layer arrangement **705**, as seen from the second side **703** of the main body **103** and as were still provided in the example according to FIG. **7**, are dispensed with.

Consequently, the assembly area **729** of the carrier component **727** is only provided with a single electrical contacting area **803**.

Consequently, the two-sided structured carriers **701**, **801** according to FIGS. **7** and/or **8** advantageously render it possible both to solder an optoelectronic component onto the first solder layer **123** and to solder the main body **103** itself, with its second side **703**, onto a further component, in this case the carrier component **727**. Consequently, the carrier component **727** carries the corresponding carrier **701**, **801**.

FIG. **9** shows a view from above on a wafer **901**. The wafer **901** comprises a plurality of carriers **101** configured according to the carrier **101** of the FIG. **3**.

One of the carriers **101** is provided with an optoelectronic component **903**. That is to say that the optoelectronic component **903** is arranged on the upper side **125** of the first solder layer **123**. If a voltage is applied to the corresponding electrical contacting portions **111**, **203** of the first heating layer arrangement **107**, only the first solder layer **123** is heated. Thus, local heating takes place. The adjacent carriers **101** are not heated or at least they are only heated to below a melting temperature of the corresponding solder layer thereof. That is to say that the adjacent carriers **101** remain below the solder temperature when the carrier **101** with the optoelectronic component **903** is heated.

FIG. **10** shows a wafer comprising a plurality of carriers **401** according to the examples of FIGS. **4** to **6** in a side view, with, here too, an optoelectronic component **903** being respectively arranged on the upper side **125** of the corresponding first solder layer **123**.

The illustration according to FIG. **10** shows the wafer **901** prior to soldering, thus prior to melting the first soldering layer **123**.

The optoelectronic component **903** projects beyond the respective first side **105** of the main body **103**, and so an edge **1001** of the component **903** projects beyond the main body **103**. What is advantageously brought about thereby is that, for example, in a light emission of the component **903**, the light usually emitted in the region of the edge **1001**, in particular, is not shadowed by the structured main body **103**.

FIG. **11** shows a flowchart of a method of producing a carrier for an optoelectronic component.

The method comprises the following steps:

providing **1101** a main body, wherein the main body comprises a first electrically conductive heating layer arrangement,

forming **1103** an electrical insulation, a thermal connection and a first solder layer for soldering an optoelectronic component to the main body on a first side of the main body such that

the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer.

One or more of the layers, as described above, may be and/or have been electrodeposited and/or vapor deposited.

FIG. **12** shows a flowchart of a soldering method using a carrier or a wafer as described above or below to solder an optoelectronic component to the main body by the first solder layer.

According to step **1201**, the first electrically conductive heating layer arrangement has a voltage or an electric current applied thereto such that the first electrically con-

ductive heating layer arrangement heats up to melt the first solder layer. When the melt temperature of the first solder layer is reached, the first solder layer melts such that the optoelectronic component is soldered by the molten solder layer to the main body according to step **1203**.

In summary, an efficient technical concept is provided such that a main body of a carrier has an electrically conductive structure which, for example, is formed on a first and/or second side of the main body and/or in the main body itself. This electrically conductive structure is referred to here as the first and/or second heating layer arrangement. This electrically conductive structure is electrically insulated from the solder layer, but thermally connected to the latter. The electrically conductive structure acts as an electrical resistance heater and produces the thermal energy necessary for soldering. Consequently, a carrier for an optoelectronic component is thus produced, the carrier having a dedicated heater to melt the solder layer or the solder layers.

Even though our carriers, wafers and methods have been described and illustrated in detail more closely by preferred examples, this disclosure is not restricted by the disclosed examples and other variations can be derived therefrom by those skilled in the art without departing from the scope of protection of the appended claims.

This application claims priorities of DE 10 2015 121 711.2 and 10 2016 106 734.2, the subject matter of which is incorporated herein by reference.

The invention claimed is:

1. A carrier for an optoelectronic component comprising:
a main body,
wherein the main body comprises a first electrically conductive heating layer arrangement,
a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body,
the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer,
the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement,
the first heating layer arrangement has a first electrical contacting portion, a second electrical contacting portion and a heating portion extending between the first solder layer and the first side, and the heating portion of the first heating layer arrangement is electrically contacted by the two electrical contacting portions of the first heating layer arrangement, and
the heating portion of the first heating layer arrangement has a two-dimensional coil structure.

2. The carrier according to claim **1**, wherein the first heating layer arrangement is electrically insulated from the first solder layer by a first electrically insulated passivation layer by virtue of the first passivation layer being arranged at least in part on the first heating layer arrangement, and the first solder layer is arranged at least indirectly on the first passivation layer.

3. The carrier according to claim **2**, wherein an electric line is formed to electrically contact the first heating layer arrangement, and the electric line extends from an upper side facing away from the first side of the main body of the first passivation layer to the first heating layer arrangement through the first passivation layer.

4. The carrier according to claim **3**, wherein the electric line is formed by the first heating layer arrangement.

5. The carrier according to claim **1**, wherein the thickness of the first electrically conductive heating layer arrangement is 15 nm to 200 nm.

6. The carrier according to claim **1**, further comprising an optoelectronic component, wherein the optoelectronic component is soldered onto the main body or soldered with the main body by the first solder layer.

7. The carrier according to claim **1**, wherein the first side of the main body is an upper side of the main body.

8. The carrier according to claim **1**, wherein the main body is configured as a submount.

9. The carrier according to claim **1**, wherein a second electrically conductive heating layer arrangement is arranged on a second side of the main body, lying opposite the first side, and the second heating arrangement is electrically insulated from a second solder layer arranged on the second side and thermally connected to the second solder layer.

10. The carrier according to claim **9**, wherein the main body is soldered onto a further carrier by the second solder layer.

11. The carrier according to claim **9**, wherein the second heating layer arrangement is electrically contacted by an electrical via extending from the first side to the second side of the main body.

12. A wafer comprising a plurality of carriers according to claim **1**.

13. A soldering method using a wafer according to claim **12**, wherein an optoelectronic component is soldered to the main body by the first solder layer by virtue of the first electrically conductive heating layer arrangement having a voltage or an electric current applied thereto such that the first electrically conductive heating layer arrangement is heated to melt the first solder layer.

14. A soldering method using a carrier according to claim **1**, wherein an optoelectronic component is soldered to the main body by the first solder layer by virtue of the first electrically conductive heating layer arrangement having a voltage or an electric current applied thereto such that the first electrically conductive heating layer arrangement is heated to melt the first solder layer.

15. The soldering method according to claim **14**, wherein molten solder of the first solder layer flows onto an exposed portion of the first heating layer arrangement to reduce an electrical resistance of the first heating layer arrangement.

16. A method of producing a carrier for an optoelectronic component comprising:
providing a main body, wherein the main body comprises a first electrically conductive heating layer arrangement, and
forming an electrical insulation, a thermal connection and a first solder layer for soldering an optoelectronic component to the main body on a first side of the main body such that the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer,
such that the first heating layer arrangement has a first electrical contacting portion, a second electrical contacting portion and a heating portion extending between the first solder layer and the first side, and the heating portion of the first heating layer arrangement is electrically contacted by the two electrical contacting portions of the first heating layer arrangement, and
such that the heating portion of the first heating layer arrangement has a two-dimensional coil structure.

17. A carrier for an optoelectronic component comprising:

a main body,

wherein the main body comprises a first electrically conductive heating layer arrangement,

a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body,

the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer,

the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement,

a second electrically conductive heating layer arrangement is arranged on a second side of the main body, lying opposite the first side, and the second heating arrangement is electrically insulated from a second solder layer arranged on the second side and thermally connected to the second solder layer,

wherein the second heating layer arrangement is electrically contacted by an electrical via extending from the first side to the second side of the main body.

18. A carrier for an optoelectronic component comprising:

a main body comprising a first electrically conductive heating layer arrangement, and

a first solder layer for soldering an optoelectronic component to the main body is arranged on a first side of the main body,

wherein the first electrically conductive heating layer arrangement is electrically insulated from the first solder layer and thermally connected to the first solder layer,

the first heating layer arrangement has an exposed portion on which molten solder of the first solder layer can flow to reduce an electrical resistance of the first heating layer arrangement,

the first electrical heating layer arrangement is structured such that it has a heating portion and two electrical contacting portions and comprises a layer stack formed from a titanium layer, a platinum layer and a gold layer, and

the titanium layer is arranged on the first side of the main body as a first layer of the layer stack, the platinum layer is arranged on the titanium layer as a second layer of the layer stack, and the gold layer is arranged on the platinum layer as a third layer of the layer stack.

19. The carrier according to claim **18**, wherein a thickness of the first electrically conductive heating layer arrangement is 15 nm to 200 nm.

20. The carrier according to claim **18**, wherein the heating portion comprises the layer stack formed from the titanium layer, the platinum layer and the gold layer.

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